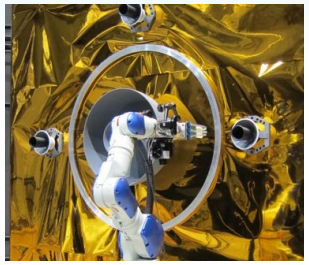
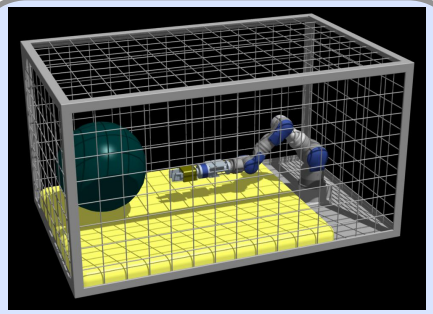
Autonomous Robotic Capture of a Free-Floating Payload in Near-Zero Gravity

STATUS QUO



- Current ground simulations of on-orbit autonomous robotic capture do not adequately model the small-scale 3D contact dynamics between a robot and a satellite
- Some 2D and large-scale/low-bandwidth 3D simulations have been performed

NEW INSIGHTS



NASA's parabolic aircraft provide a unique opportunity to collect data in a zero-g environment in order to advance the fidelity of ground simulations.

MAIN ACHIEVEMENT:

Autonomous robotic capture technologies are being developed to advance the state of robotic servicing technology. A test cage will be flown containing a robotic arm and a free-floating mock satellite that will be autonomously captured.

HOW IT WORKS:

The robot will be fixed to the cage, which will be fixed to the aircraft. During each zero-g period, the mock satellite will be released so that it is free-floating within the cage. The robot will then try to track and grapple the mock satellite using its onboard sensing. A metrology system will independently measure the motion of the arm and mock satellite.

LIMITATIONS:

Each parabola provides only 25 s of zero-g to setup the system and perform capture

EXPECTED PERFORMER:

NASA/Goddard Space Flight Center: Robot control

West Virginia University: Sensing algorithms

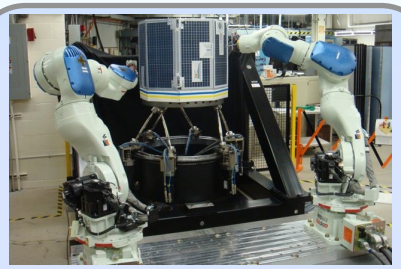
U.S. Naval Research Lab: Metrology system

Yaskawa America, Inc: Robot manufacturer

SCHEDULE:

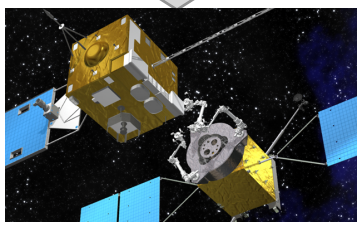
June-July:	System development, I&T
July:	Zero-g testing
July-Sept:	Improvement and validation of ground simulations

QUANTITATIVE IMPACT



- Motion data for the robot and mock satellite will be recorded to replay on ground simulation platforms
- Contact dynamics data will be gathered to validate ground simulations
- Robot sensing data will be captured to further refine capture algorithms

END-OF-PHASE GOAL



Data collected will advance ground simulation fidelity and help NASA address the following RTA Technical Areas: 4.1) Sensing and perception 4.3) Manipulation 4.6) Autonomous rendezvous and docking

These zero-g tests will provide critical data to advance ground simulations which are key to enabling reliable on-orbit robotic satellite servicing